MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

BQT1614 – QUANTITATIVE ANALYSIS

(All Sections/Groups)

14 OCTOBER 2019
2.30 p.m.- 5.30 p.m.
(3 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of TEN (10) pages (excluding the cover page).

2. Answer **ALL** questions. The marks distributions are given in parentheses.

3. The Formulae Sheet and the Statistical Tables are provided.

4. Please write all your answers in the answer booklets provided.

QUESTION 1

a) A researcher would like to study whether counselling could help people lose weight. Hence, the number of pounds lost for 12 people who went through a series of counselling for a period of six months were collected.

18.2	24.8	3.9	20.2	17.6	8.9
17.3	33.8	29.4	18.5	31.6	19.6

i) Determine the mean and median for the number of pounds lost. Interpret the value.

(8 marks)

ii) Determine the variance and range for the number of pounds lost.

(4 marks)

iii) Determine the coefficient of variation for the number of pounds lost.

(3 marks)

b) A random sample of 30 lunch orders at Mc Donald's drive-through at Cyberjaya showed a mean bill of RM12.15 with a standard deviation of RM7.50. Find a 99% confidence interval for the mean bill of the lunch orders at Mc Donald's drive-through at Cyberjaya.

(5 marks)

(Total: 20 marks)

QUESTION 2

a) In the past 50 years, the average number of deaths due to alligators in Florida is 0.4 death per year.

i) Find the probability of no death due to alligators in November 2019.

(3 marks)

ii) Find the probability of at least two deaths due to alligators within the first six months of a year.

(7 marks)

b) Procyon Manufacturing produces tennis balls. Their manufacturing process has a mean ball weight of 2.035 ounces with a variance of 0.0009 ounce. Regulation set the standard weight of a tennis ball to be between 1.975 ounces and 2.095 ounces.

i) Find the probability that a produced tennis ball has weight less than 2.13 ounces.

(4 marks)

ii) Find the probability that a produced tennis ball fails to meet the required specification.

(6 marks)

(Total: 20 marks)

Continued...

QUESTION 3

A group of researchers would like to conduct a research on young working adults' monthly expenses. Based on past record the average monthly expenses of young working adults in Melaka is RM1570 in 2015. Recently, the researchers have selected a random sample of 25 young working adults from Melaka and revealed that the mean monthly expenses is RM1748 with a standard deviation of RM260.

a) At the 0.05 significance level, test if the average monthly expenses has increased compared to 2015.

(8 marks)

b) The researchers had rearranged the data according to gender. The following is the information obtained

	Male	**Female**
Mean	RM1850	RM1680
Standard deviation	RM320	RM300
Sample size	10	15

At the 0.01 significance level and assume equal variances, test if the average monthly expenses of male young working adults is higher than the average monthly expenses of female young working adults.

(12 marks)
(Total: 20 marks)

Continued...

QUESTION 4

A medical centre wants to develop a model to predict the weight of newborn babies. A sample of 15 newborn babies was selected. Their weight and their mother's weight were recorded in the following table:

Newborn baby's weight (Kg)	Mother's weight (Kg)
2.0	50
1.9	49
3.1	61
2.1	49
1.9	50
2.3	55
2.5	52
2.6	53
2.4	54
2.6	51
2.9	56
2.0	48
2.9	61
3.0	62
2.6	55

a) Identify the independent and dependent variables.

(2 marks)

b) Assuming a linear relationship, use the least-squares method to obtain the regression line equation.

(6 marks)

c) Interpret the meaning of the slope obtained in (b).

(2 marks)

d) Use the regression line obtained in (b) to predict the weight of a newborn baby for a mother whose weight is 52kg. Is the estimation reliable?

(4 marks)

e) Determine the coefficient of correlation and interpret its meaning.

(4 marks)

f) Determine the coefficient of determination and interpret its meaning.

(2 marks)

(Total: 20 marks)

Continued...

QUESTION 5

a) Karen started a 5-year monthly saving plan which earns interest of 3.2%/year compounded monthly. Under the saving plan, Karen is required to deposit RM450 at the end of each month into the account. Jimmy would like to have the same amount as Karen through a onetime deposit into a saving account which earns interest of 4%/ year compounded quarterly. How much should Jimmy deposit into the saving account, so that he will get the same amount as Karen at the end of 5 years?

(6 marks)

b) How long will it take for an investment of RM25,000 to earn RM1500 interest if it is invested in a saving account paying interest of 3.5%/ year compounded monthly?

(4 marks)

c) Jimmy is looking into two investment plans, A and B. Investment Plan A is a high risk high return plan which gives interest of 6%/year compounded monthly. Investment Plan B is a low risk low return plan which earns interest of 3%/ year compounded quarterly. Assuming that he is planning to invest the same amount in either one of the plans, how long it will take for Investment Plan B to yield the same accumulate amount obtained from the investment of 5 years in Investment Plan A.

(5 marks)

d) The following is the information of a list of stationery which is used by a student in the year 2010 and 2018.

Stationery	2010		2018	
	Price (RM)	Quantity	Price (RM)	Quantity
Pen	2.00	7	3.50	5
A4 paper	9.50	2	11.50	3
Notebook	3.50	2	5.50	3
A4 Writing pad	2.50	2	4.50	4

i) Determine the unweighted aggregate price Index for these stationery for the year 2018 by using the year 2010 as the base year.

(2 marks)

ii) Determine the Laspeyres aggregate price Index for these stationery for the year 2018 by using the year 2010 as the base year.

(3 marks)

(Total: 20 marks)

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APPENDIXES:

I. STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Sample mean: $\bar{X} = \frac{\sum x}{n}$

Sample standard deviation: $S = \sqrt{\frac{\sum x^2}{n-1} - \frac{(\sum x)^2}{n(n-1)}}$

Coefficient of variation (sample): $CV = \frac{S}{\bar{X}} \times 100\%$

Pearson coefficient of skewness: $S_K = \frac{3(\bar{X} - Median)}{S}$

B. PROBABILITY

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A \cap B) = P(A) \times P(B)$ if A and B are independent

$P(A \mid B) = P(A \cap B) \div P(B)$

Poisson Probability Distribution

If X follows a Poisson Distribution P (λ) where $P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}$

then the mean = E(X) = λ and variance = VAR(X) = λ

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = E(X) = np and variance = VAR(X) = npq where q = 1 - p

Normal Distribution

If X follows a Normal distribution N(μ , σ) where E(X) = μ and VAR(X) = σ^2

then $Z = \frac{X - \mu}{\sigma}$

C. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

$(100-\alpha)\%$ Confidence Interval for Population Mean:

If σ known, μ: $\bar{x} \pm Z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$

If σ unknown, μ: $\bar{x} \pm t_{\alpha/2,n-1}\frac{s}{\sqrt{n}}$

$(100-\alpha)\%$ Confidence Interval for Population Proportion, π: $p \pm Z_{\alpha/2}\sqrt{\frac{p(1-p)}{n}}$

Sample Size Determination for Population Mean: $n = \left(\frac{(Z_{\alpha/2})\ \sigma}{e}\right)^2$

Sample Size Determination for Population Proportion: $n = \frac{(Z_{\alpha/2})^2 \pi(1-\pi)}{e^2}$

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D. HYPOTHESIS TESTING

One Sample Mean Test

***Z*-test:** $Z = \dfrac{\bar{x} - \mu}{\dfrac{\sigma}{\sqrt{n}}}$ ***t*-test:** $t = \dfrac{\bar{x} - \mu}{\dfrac{s}{\sqrt{n}}}$

One Sample Proportion Test

$$Z = \frac{p - \pi}{\sqrt{\dfrac{\pi(1-\pi)}{n}}}$$

Two Sample Mean Test

***Z*-test:** $$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$$

***t*-test:** $$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}} \quad \text{where} \quad s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

Two Sample Proportion Test

$$Z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left[\dfrac{1}{n_1} + \dfrac{1}{n_2}\right]}} \quad \text{where} \quad \bar{p} = \frac{x_1 + x_2}{n_1 + n_2}; \quad p_1 = \frac{x_1}{n_1}; \quad p_2 = \frac{x_2}{n_2}$$

E. REGRESSION ANALYSIS

Simple Linear Regression

$y_i = b_0 + b_1 x_i$ where $b_0 = \bar{Y} - b_1\bar{X}$ and $b_1 = \dfrac{\sum XY - \left[\dfrac{\sum X \sum Y}{n}\right]}{\left[\sum X^2 - \left(\dfrac{(\sum X)^2}{n}\right)\right]}$

Correlation Coefficient

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

ANOVA Table for Regression

Source	Degrees of Freedom	Sum of Squares	Mean Squares
Regression	*1*	SSR	MSR = SSR/1
Error/Residual	$n - 2$	SSE	MSE = SSE/$(n - 2)$
Total	$n - 1$	SST	

Test Statistic for Significance of the Predictor Variable

$t_i = \dfrac{b_i}{S_{b_i}}$ and the critical value = $\pm t_{\alpha/2,(n-p-1)}$ where p = number of predictor

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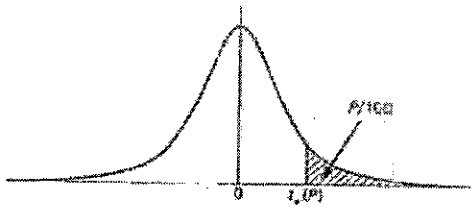
TABLE 10. PERCENTAGE POINTS OF THE t-DISTRIBUTION

This table gives percentage points $t_\nu(P)$ defined by the equation

$$\frac{P}{100} = \frac{1}{\sqrt{\nu\pi}} \frac{\Gamma(\frac{1}{2}\nu + \frac{1}{2})}{\Gamma(\frac{1}{2}\nu)} \int_{t_\nu(P)}^{\infty} \frac{dt}{(1 + t^2/\nu)^{\frac{1}{2}(\nu+1)}}.$$

Let X_1 and X_2 be independent random variables having a normal distribution with zero mean and unit variance and a χ^2-distribution with ν degrees of freedom respectively; then $t = X_1/\sqrt{X_2/\nu}$ has Student's t-distribution with ν degrees of freedom, and the probability that $t \geqslant t_\nu(P)$ is $P/100$. The lower percentage points are given by symmetry as $-t_\nu(P)$, and the probability that $|t| \geqslant t_\nu(P)$ is $2P/100$.



The limiting distribution of t as ν tends to infinity is the normal distribution with zero mean and unit variance. When ν is large interpolation in ν should be harmonic.

P	40	30	25	20	15	10	5	2·5	1	0·5	0·1	0·05
$\nu = 1$	0·3249	0·7265	1·0000	1·3764	1·963	3·078	6·314	12·71	31·82	63·66	318·3	636·6
2	0·2887	0·6172	0·8165	1·0607	1·386	1·886	2·920	4·303	6·965	9·925	22·33	31·60
3	0·2767	0·5844	0·7649	0·9785	1·250	1·638	2·353	3·182	4·541	5·841	10·21	12·92
4	0·2707	0·5686	0·7407	0·9410	1·190	1·533	2·132	2·776	3·747	4·604	7·173	8·610
5	0·2672	0·5594	0·7267	0·9195	1·156	1·476	2·015	2·571	3·365	4·032	5·893	6·869
6	0·2648	0·5534	0·7176	0·9057	1·134	1·440	1·943	2·447	3·143	3·707	5·208	5·959
7	0·2632	0·5491	0·7111	0·8960	1·119	1·415	1·895	2·365	2·998	3·499	4·785	5·408
8	0·2619	0·5459	0·7064	0·8889	1·108	1·397	1·860	2·306	2·896	3·355	4·501	5·041
9	0·2610	0·5435	0·7027	0·8834	1·100	1·383	1·833	2·262	2·821	3·250	4·297	4·781
10	0·2602	0·5415	0·6998	0·8791	1·093	1·372	1·812	2·228	2·764	3·169	4·144	4·587
11	0·2596	0·5399	0·6974	0·8755	1·088	1·363	1·796	2·201	2·718	3·106	4·025	4·437
12	0·2590	0·5386	0·6955	0·8726	1·083	1·356	1·782	2·179	2·681	3·055	3·930	4·318
13	0·2586	0·5375	0·6938	0·8702	1·079	1·350	1·771	2·160	2·650	3·012	3·852	4·221
14	0·2582	0·5366	0·6924	0·8681	1·076	1·345	1·761	2·145	2·624	2·977	3·787	4·140
15	0·2579	0·5357	0·6912	0·8662	1·074	1·341	1·753	2·131	2·602	2·947	3·733	4·073
16	0·2576	0·5350	0·6901	0·8647	1·071	1·337	1·746	2·120	2·583	2·921	3·686	4·015
17	0·2573	0·5344	0·6892	0·8633	1·069	1·333	1·740	2·110	2·567	2·898	3·646	3·965
18	0·2571	0·5338	0·6884	0·8620	1·067	1·330	1·734	2·101	2·552	2·878	3·610	3·922
19	0·2569	0·5333	0·6876	0·8610	1·066	1·328	1·729	2·093	2·539	2·861	3·579	3·883
20	0·2567	0·5329	0·6870	0·8600	1·064	1·325	1·725	2·086	2·528	2·845	3·552	3·850
21	0·2566	0·5325	0·6864	0·8591	1·063	1·323	1·721	2·080	2·518	2·831	3·527	3·819
22	0·2564	0·5321	0·6858	0·8583	1·061	1·321	1·717	2·074	2·508	2·819	3·505	3·792
23	0·2563	0·5317	0·6853	0·8575	1·060	1·319	1·714	2·069	2·500	2·807	3·485	3·768
24	0·2562	0·5314	0·6848	0·8569	1·059	1·318	1·711	2·064	2·492	2·797	3·467	3·745
25	0·2561	0·5312	0·6844	0·8562	1·058	1·316	1·708	2·060	2·485	2·787	3·450	3·725
26	0·2560	0·5309	0·6840	0·8557	1·058	1·315	1·706	2·056	2·479	2·779	3·435	3·707
27	0·2559	0·5306	0·6837	0·8551	1·057	1·314	1·703	2·052	2·473	2·771	3·421	3·690
28	0·2558	0·5304	0·6834	0·8546	1·056	1·313	1·701	2·048	2·467	2·763	3·408	3·674
29	0·2557	0·5302	0·6830	0·8542	1·055	1·311	1·699	2·045	2·462	2·756	3·396	3·659
30	0·2556	0·5300	0·6828	0·8538	1·055	1·310	1·697	2·042	2·457	2·750	3·385	3·646
32	0·2555	0·5297	0·6822	0·8530	1·054	1·309	1·694	2·037	2·449	2·738	3·365	3·622
34	0·2553	0·5294	0·6818	0·8523	1·052	1·307	1·691	2·032	2·441	2·728	3·348	3·601
36	0·2552	0·5291	0·6814	0·8517	1·052	1·306	1·688	2·028	2·434	2·719	3·333	3·582
38	0·2551	0·5288	0·6810	0·8512	1·051	1·304	1·686	2·024	2·429	2·712	3·319	3·566
40	0·2550	0·5286	0·6807	0·8507	1·050	1·303	1·684	2·021	2·423	2·704	3·307	3·551
50	0·2547	0·5278	0·6794	0·8489	1·047	1·299	1·676	2·009	2·403	2·678	3·261	3·496
60	0·2545	0·5272	0·6786	0·8477	1·045	1·296	1·671	2·000	2·390	2·660	3·232	3·460
120	0·2539	0·5258	0·6765	0·8446	1·041	1·289	1·658	1·980	2·358	2·617	3·160	3·373
∞	0·2533	0·5244	0·6745	0·8416	1·036	1·282	1·645	1·960	2·326	2·576	3·090	3·291

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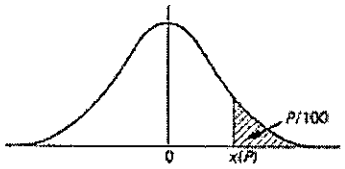
TABLE 5. PERCENTAGE POINTS OF THE NORMAL DISTRIBUTION

This table gives percentage points $x(P)$ defined by the equation

$$\frac{P}{100} = \frac{1}{\sqrt{2\pi}} \int_{x(P)}^{\infty} e^{-\frac{1}{2}t^2}\, dt.$$

If X is a variable, normally distributed with zero mean and unit variance, $P/100$ is the probability that $X \geq x(P)$. The lower P per cent points are given by symmetry as $-x(P)$, and the probability that $|X| \geq x(P)$ is $2P/100$.



P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$
50	0·0000	5·0	1·6449	3·0	1·8808	2·0	2·0537	1·0	2·3263	0·10	3·0902
45	0·1257	4·8	1·6646	2·9	1·8957	1·9	2·0749	0·9	2·3656	0·09	3·1214
40	0·2533	4·6	1·6849	2·8	1·9110	1·8	2·0969	0·8	2·4089	0·08	3·1559
35	0·3853	4·4	1·7060	2·7	1·9268	1·7	2·1201	0·7	2·4573	0·07	3·1947
30	0·5244	4·2	1·7279	2·6	1·9431	1·6	2·1444	0·6	2·5121	0·06	3·2389
25	0·6745	4·0	1·7507	2·5	1·9600	1·5	2·1701	0·5	2·5758	0·05	3·2903
20	0·8416	3·8	1·7744	2·4	1·9774	1·4	2·1973	0·4	2·6521	0·01	3·7190
15	1·0364	3·6	1·7991	2·3	1·9954	1·3	2·2262	0·3	2·7478	0·005	3·8906
10	1·2816	3·4	1·8250	2·2	2·0141	1·2	2·2571	0·2	2·8782	0·001	4·2649
5	1·6449	3·2	1·8522	2·1	2·0335	1·1	2·2904	0·1	3·0902	0·0005	4·4172

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